Prof. Joseph Le Conte in the instance of the Florida reefs. He then pointed out that since corals will not grow on muddy shores or in water upon the bottom of which sediment is collected, the favourable conditions can only be obtained at some distance from the shore, where a barrier-reef would ultimately be formed *limited on one side by the muddiness and on the other by the depth of the water*.

The foregoing conditions may be described as the determining causes of a barrier-reef. After the reef has been formed, the lagoon-channel will be kept open by such agencies as solution, diminished food-supply, tidal scour, organic degradation, and other influences The circumstance that barrier-reefs are frequently situated at or near the borders of submarine plateaus receives a ready explanation in the view first advanced by Prof. Le Conte, since in such situations the necessary conditions of depth and clearness would be found.

Anomalous Depths of some Atolls and Barrier-Reefs.—One of the principal arguments in favour of the theory of subsidence lies in the assertion that lagoons and lagoon-channels are sometimes deeper than the reef-coral zone. I will, however, endeavour to show that this assertion is founded on a misconception of the conditions that limit the depth of this zone. The extent to which the depth may vary is demonstrated in the great divergence between the estimates of different observers in every region of coral reefs. Those of Quoy and Gaimard, Ehrenberg, Darwin, Dana, Murray, A. Agassiz, and others, range from 5 to 40 fathoms. But this variation may also be found in the same region of coral reefs. Thus, in the Solomon Islands, I found that the depths at which reef-corals flourished ranged in different localities from 12 to 40 fathoms and beyond, the variation being due to differences of local conditions, such as the degree of inclination of the submarine slope, the presence and position of submarine declivities, the amount of sediment held in suspension, the force of the breakers, and other influences. The main determining condition, as Prof. A. Agassiz points out, is to be found in the injurious effect of sand and sediment rather than in the general influence of depth; and the distribution of these materials is dependent on the local conditions above referred to. Local conditions will usually restrict the reef-coral zone to depths less than 30 fathoms; but, where there is a gradual submarine slope, reef-corals are to be found in depths beyond the sand and gravel. Inasmuch as most observers have regarded these materials as necessarily limiting the zone, they did not push their inquiries beyond. Under favourable conditions, however, reef-corals may thrive in depths of 50 or 60 fathoms; and thus we can readily explain the apparently abnormal depths inside some atolls and barrier-reefs.

An apparent objection here presents itself. If reefs begin to build their foundations in depths greater than those which are generally assigned to them, the thickness of the elevated reef-formations discovered by me in the Solomon Group should have been much greater than 150 feet, the actual limit of their thickness. It will, however, have been gathered from the previous remarks that local conditions will usually confine reef-corals to depths less than 25 or 30 fathoms, and that it will be only under occasional circumstances that reefs will commence to be formed in deeper water. Fringing-reefs themselves are at first restricted to shallow waters around the coast, and their seaward extension in localities where the submarine slope is at all steep, as is generally the case, must be extremely slow. Again, in an area of elevation, such as that in which the Solomon Islands are included, barrier-reefs, which may have begun to grow in depths not less than 50 fathoms, might owe their approach towards the surface as much to the elevating movement as to the very slow upward growth of the corals. It should also be borne in mind that the rapid subaërial denudation, to which these regions of heavy rainfall are subjected, would be an important agency in the thinning away of the raised coral formations.

In the latter part of my paper I refer, amongst other subjects, to the extensive character of the degradation of coral reefs by multitudes of organisms. I also give proofs of the outward growth of reefs on their own talus (as described by Murray)—(1) in the circumstance that massive corals may be commonly observed to increase in size as one approaches the lagoon from the outer margin of the reef-flat; (2) in the presence of old lines of erosion evidently produced at the existing sea-level, but which have been cut off from the action of the waves by the advancing edge of the reef-flat; (3) in the characters and position of the wooded islets situated on reefs, which in course of time would cover the whole reef-flat, were it not for one counteracting circumstance, the seaward growth of the reef.

Lastly, I refer to the deposits at present forming on the outer slopes of reefs in depths down to 100 fathoms. Reef-debris, foraminiferous tests, especially of *Orbitolites*, joints of the calcareous alga *Halimeda opuntia*, portions of *Nulliporæ*, and the small detached corals of the genus *Heteropsammia*, enter largely into the composition of these deposits. I should add that a rock of this composition is one of the commonest types of the so-called coral limestones in the Solomon Group.

In this short abstract of a long paper I have not been able to do much more than indicate the general bearing of my conclusions. The facts and data are given at length in the original paper.

THE BRITISH ASSOCIATION AND LOCAL SCIENTIFIC SOCIETIES

THE second annual Conference of Delegates held under the new rules of the British Association met at Birmingham on September 2 and 7, in the library of the Medical Institute. Forty-nine local Societies carrying on work in various parts of the United Kingdom have been enrolled this year as "Corresponding Societies" of the Association, and of these thirty-two were represented by Delegates at the Birmingham meeting. The following report of the proceedings of the Conference, signed by Mr. Francis Galton and Prof. R. Meldola, the Chairman and Secretary of the Committee, has just been circulated among the Corresponding Societies, and it will be seen that this new branch of the work of the Association promises to be of mutual advantage both to the Societies and the Association:—

At the first Conference the chair was taken by Dr. A. W. Williamson, F.R.S., General Treasurer of the British Association, the Corresponding Societies Committee being represented by Captain Douglas Galton, F.R.S., General Secretary of the Association, Dr. Garson, Mr. John Hopkinson, F.L.S., and Prof. R. Meldola, F.R.S., Secretary.

The Secretary read the Report of the Corresponding Societies Committee which had been presented to the Council of the Association.

The Chairman made some remarks explanatory of the objects of the Conference of Delegates, and suggested that among other subjects of investigation in which it might be useful to secure the co-operation of the local Societies was that of injurious insects, already so much studied by Miss E. A. Ormerod.

The Secretary also made some observations in explanation of the constitution of the Corresponding Societies Committee and the relations existing between the Conference of Delegates and the British Association.

Some remarks were made by Mr. J. W. Davis and others with reference to the advisability of securing the co-operation of the local Societies for the purpose of investigating British Barrows and other prehistoric remains. This suggestion had been put forward at the Aberdeen Conference last year by Prof. Meldola, and a Committee was about to be formed by Section H for carrying out this object.

Mr. H. Heywood considered that the relationship now existing between the British Association and the Corresponding Societies had already been of great assistance to the Societies themselves. In the case of his own Society (Cardiff) they had been able to assist one of the Committees (Erratic Blocks) brought under the notice of the Aberdeen Conference last year.

Prof. Lebour stated that many of the local Societies, such as the North of England Institute, which he represented, were composed of engineers connected with large works, who might make useful investigations which would be facilitated if backed up by the authority of the British Association. For this reason he hoped that other subjects besides natural history, geology, or anthropology would be recognised at the Conferences.

Captain Galton explained that the object of the Conference of Delegates was to bring the Corresponding Societies into direct communication with *all* the Committees of the British Association, to which the local Societies or individual members of these might render assistance. This could of course be only effected by degrees, but he suggested that as a preliminary step it might be found useful to place the Delegates on the Committees of those Sections in which they or their Societies had the most interest.

Dr. Williamson supported this proposition, and the Secretary took down the names of the Delegates to be attached to the various Sectional Committees.

Prof. Hillhouse and Dr. Garson expressed their willingness, as Secretaries of Sections D and H respectively, to propose Delegates as members of the Sectional Committees.

Mr. Hopkinson suggested that among other methods of promoting work among local Societies it might be found advantageous for the Delegates themselves to make suggestions at the Conference which might lead, through the proper channels, to the formation of new Committees by the British Association. He stated that his own Society (Hertfordshire) had already rendered material assistance to the Erratic Blocks Committee of the Association, and they hoped to render similar service to the Underground Waters Committee.

The following resolution, framed with the object of keeping the Corresponding Societies informed of the work being done by the British Association Committees, was moved by Dr. Garson, seconded by Captain Galton, and passed unanimously:—

"That the Secretary of the British Association be requested to send a list of the several Committees appointed by the Association to each of the Delegates of the Corresponding Societies, or to the Secretaries of these Societies, as soon as possible after the meeting of the Association, together with a copy of the proceedings of the meetings of the Conference of Delegates."

At the second Conference the chair was taken in the absence of Dr. Williamson by Prof. Boyd Dawkins, F.R.S., the Corresponding Societies Committee being represented by Dr. Garson, Mr. John Hopkinson, F.L.S., and the Secretary, Prof. R. Meldola, F.R.S.

The Secretary read the minutes of the proceedings of the first Conference, and it was stated that in accordance with the decision then arrived at the Delegates had been placed on the respective Sectional Committees as "Delegate Members."

The Chairman directed attention to the kind of work which might be done at the Conferences, stating that as a member of the Council of the British Association he knew that the Association was anxious to consolidate the work of the local Societies. He suggested that the best mode of procedure would be to take the different Sections *seriatim*, and hear the recommendations forwarded by the Committees of these Sections, together with suggestions by the Delegates respecting the lines of investigation in which the local Societies could take part.

SECTIONS A AND B.—No recommendations from the Committees of these Sections having been forwarded to the Secretary of the Conference, the Chairman invited suggestions from the Delegates.

Luminous Meteors.—Mr. F. T. Mott suggested that much useful work might be done if the local Societies would undertake to record systematically the appearance, position, direction, &c., of luminous meteors.

The Secretary stated that a Committee of the British Association was for many years in existence for the purpose of carrying out these observations, but, for some reason unknown to him, the Committee appeared now to have ceased its labours.

Magnetic and Tidal Observations.—Mr. J. Martin White suggested that some of the local Societies which were favourably situated for the purpose might undertake systematic observations of local tidal and magnetic phenomena.

Meteorological and Phenological Observations. — Mr. Heywood stated that many valuable meteorological observations were buried in the log-books of steamships, and suggested that some of the local Societies might render good service to meteorology by examining these books and keeping records of any important entries. Mr. Hopkinson pointed out two ways in which the local Societies might advance meteorological science. In the first place he thought that many observers in different parts of the country might be in the habit of recording the rainfall or other meteorological phenomena without communicating the results to Mr. Symons. Good service would be rendered if the Corresponding Societies would find out such observers and put them into communication with Mr. Symons.[1] In the next place he suggested that observations of the time of flowering of plants, first appearances of birds and insects, &c., might be systematically recorded and forwarded to the Royal Meteorological Society by those observers who had not hitherto been in the habit of communicating their results to that Society.

SECTION C.—Mr. C. E. De Rance, F.G.S., attended the Conference on behalf of the Committee of this Section. The three following recommendations were forwarded by the Secretary of the Section:—

Sea Coasts Erosion.—"That Messrs. R. B. Grantham, C. E. De Rance, J. B. Redman, W. Topley, W. Whitaker, and J. W. Woodall, Major-General Sir A. Clarke, Admiral Sir E. Ommanney, Sir J. N. Douglass, Captain J. Parsons, Captain W. J. L. Wharton, Prof. J. Prestwich, and Messrs. E. Easton, J. S. Valentine, and L. F. Vernon Harcourt be reappointed a Committee for the purpose of inquiring into the Rate of Erosion of the Sea Coasts of England and Wales, and the influence of the Artificial Abstraction of Shingle or other Material in that Action; that Messrs. De Rance and Topley be the Secretaries."

Underground Waters.—"That Prof. E. Hull, Dr. H. W Crosskey, Captain Douglas Galton, Prof. J. Prestwich, and Messrs. James Glaisher, E. B. Marten, G. H. Morton, James Parker, W. Pengelly, James Plant, I. Roberts, Fox-Strangways, T. S. Stooke, G. J. Symons, W. Topley, Tylden-Wright, E. Wethered, W. Whitaker, and C. E. De Rance be reappointed a Committee for the purpose of investigating the Circulation of the Underground Waters in the Permeable Formations of England, and the Quality and Quantity of the Waters supplied to various towns and districts from these formations; and that Mr. De Rance be the Secretary."

Erratic Blocks.—"That Profs. J. Prestwich, W. Boyd Dawkins, T. McK. Hughes, and T. G. Bonney, Dr. H. W.

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[1] G. J. Symons, F.R.S., 62, Camden Square, London, N.W.

Crosskey, and Messrs. C. E. De Rance, H. G. Fordham, J. E. Lee, D. Mackintosh, W. Pengelly, J. Plant, and R. H. Tiddeman be reappointed a Committee for the purpose of recording the position, height above the sea, lithological characters, size, and origin of the Erratic Blocks of England, Wales, and Ireland, reporting other matters of interest connected with the same, and taking measures for their preservation; and that Dr. Crosskey be the Secretary."

Mr. De Rance described the above three inquiries undertaken by Section C, in which it was thought the Corresponding Societies could render valuable assistance. Forms of inquiry had been circulated largely by these Committees, and it was suggested that any work done by the Corresponding Societies should be on these forms printed by the British Association. Mr. De Rance stated that forms would always be supplied to the Secretaries of Corresponding Societies applying for them.

Dr. Crosskey made some remarks explanatory of the work of the Erratic Blocks Committee. He stated that the assistance of the local Societies would be particularly valuable in this inquiry, and that he would be happy to supply the necessary forms to the Corresponding Societies in the hope that they would be filled up. He urged upon the Delegates the necessity for preserving these boulders, which were everywhere being broken up, and were rapidly disappearing from off the face of the country.[1]

Earth-Tremors.—Prof. Lebour stated that for some time past the North of England Institute of Mining and Mechanical Engineers had had a Committee actively engaged on the subject of earth-tremors and their possible connection with mine-explosions. This subject was naturally related to those of Sections A, C, and G of the British Association, and its investigation might be powerfully promoted by them. Some of the Corresponding Societies might aid greatly in making and recording observations on earth-tremors in various parts of the country. The more extensive the area over which such observations were made (if by competent observers and with suitable instruments) the more valuable they become; but it was very important that there should be some general understanding between the observers in different parts of the country, in order that some degree of that uniformity which is so desirable in matters of this kind should be attained. The cost of the expensive instruments necessary would be much lessened if large numbers of them were used. The question of earth-tremor observations was only one of many in which the engineering Societies and the British Association could be mutually useful, the former carrying out the work and the latter lending the influence of its official recognition and support.

The Rev. J. M. Mello stated that colliery proprietors were generally unwilling to spend money in investigations unless some very specific form of inquiry was circulated.

Mr. Hopkinson remarked that the Corresponding Societies, if supplied with the necessary forms, would no doubt be willing to circulate them among their members. Mr. Heywood thought the suggestion for observing and recording earth-tremors a most valuable one, and he remarked that the Cardiff Society would be happy to assist in the investigation if the formation of a Committee was sanctioned by the Association.

SECTION D.—The Committee of this Section was represented by Prof. W. Hillhouse, M.A., F.L.S.

Preservation of Native Plants.—In reply to a question by the Secretary, Prof. Hillhouse stated that in response to the inquiries which he had circulated among the Delegates and others likely to furnish information, he had received details from twelve or fourteen localities recording between two and three hundred disappearances of plants. Mr. Stirrup stated that for years past a great destruction of plants had been going on in the Manchester district, and the local Societies had found it necessary to strongly inculcate among their members the necessity of preventing this extermination. Mr. Hopkinson remarked that a similar rule had been always observed by the Hertfordshire Society with respect both to animals and plants, and he thought that all the local Societies should adopt it. Mr. Mott pointed out that one practical result illustrating the benefit of Prof. Hillhouse's resolution had been the omission of the localities of all the rare ferns and orchids from the flora of Leicestershire, which his Society was just about to publish.

Local Museums Committee.—Mr. Mott stated that a joint Committee, composed of representatives of Sections C and D, had been recommended for appointment for the purpose of reporting upon the provincial museums of the United Kingdom. The work of this Committee would be much facilitated by the co-operation of the local Societies, and he hoped that the Delegates would bring the matter under the notice of their respective Societies. The Committee consists of Mr. V. Ball, Mr. H. G. Fordham, Profs. Haddon and Hillhouse, Dr. Macfarlane, Prof. Milnes Marshall, Mr. Mott (Secretary), Dr. Traquair, and Dr. Henry Woodward.

In reply to a question as to whether the work of this Committee was to be confined to public or to extend to private museums, Mr. Mott stated that it might be found desirable to extend the report to some few private museums.

The Chairman remarked that the Local Museums Committee was one of the most important that had yet been formed. The local museums of this country were generally in a most deplorable state, and one of the first things to be done was to exclude from such collections all extraneous specimens that were not truly local. According to his experience, he had found that it was impossible for a local Society to flourish and at the same time to carry on a large museum successfully. The two organisations should be independent, but at the same time it was most desirable that the objects collected by local Societies should be handed over to the nearest local museum. With reference to this question of local museums, he considered that we in this country were much behind Germany, America, and France.

A short discussion took place with reference to the naming of specimens in local museums, in which Mr. Eve, Mr. Hopkinson, and the Chairman took part.

SECTION H.—The Committee of this Section was represented by Dr. Garson, who stated that one Committee which was about to be formed on the recommendation of their Section had arisen from the suggestion made by Mr. J. W. Davis at the last Conference.

Prehistoric Remains.—The following is the resolution sent up to and adopted by the Committee of Recommendations:—"That Sir John Lubbock, Dr. R. Munro, Mr. Pengelly, Prof. Boyd Dawkins, Dr. Muirhead, and Mr. J. W. Davis be appointed a Committee to ascertain and record the localities in the British Islands in which evidence of the existence of prehistoric inhabitants of the country is found."

Prof. Meldola stated that three years ago he had brought this subject under the notice of the Delegates in a paper which he had read at the Southport meeting of the Association, and which had been published in abstract in the volume of Reports for 1883, and *in extenso* in the *Transactions* of the Essex Field Club.[1] He remarked that the work which the Committee proposed to undertake was of the greatest national importance in view of the great destruction of ancient remains that had been going on for many years.

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[1] The addresses of the Secretaries of these three Committees are:—

Underground Waters.—C. E. De Rance, F.G.S., A.I.C.E., 28, Jermyn Street, London, S.W.

Erratic Blocks.—Rev. H. W. Crosskey, LL.D., F.G.S., 117, Gough Road, Edgbaston, Birmingham.

Sea Coasts Erosion.—Wm. Topley, F.G.S., A.I.C.E., 28, Jermyn Street, London, S.W.

[1] See NATURE, vol. xxix. p. 19.

The Chairman remarked that the subject was undoubtedly one of great importance, and some of the local Societies had already commenced to record the position of these remains on the Ordnance maps. He stated that according to his experience the 1-inch map could be used, but the 6-inch map would be found much better. One desideratum in the work was a good system of symbols; such a system had been employed in a map of ancient remains recently published in France, and he stated that he should be happy to place this system at the disposal of the Committee. He added that he was glad to be able to announce that he had succeeded in getting an Act passed for the preservation of the ancient monuments of the Isle of Man.

Preservation of Stonehenge.—Dr. Garson stated that the Committee of Section H had forwarded a resolution to the Committee of Recommendations with reference to the preservation of Stonehenge, and, pending its consideration by this Committee, it had been suggested that it should also be brought under the notice of the Corresponding Societies through their Delegates, with the object of these using their influence, as far as possible, for the preservation of this and other monuments throughout the country. The following is the resolution referred to:[1]—"That the attention of the proprietor of Stonehenge be called to the danger in which several of the stones are at the present time from the burrowing of rabbits, and also to the desirability of removing the wooden props which support the horizontal stones of one of the trilithons, and, in view of the great value of Stonehenge as an ancient monument, to express the hope of the Association that some steps will be taken to remedy these sources of danger to the stones."

This resolution had originated last April during a joint meeting of the Geologists' Association and the Hampshire Field Club on Salisbury Plain, when copies were ordered to be forwarded to the proprietor, to the Inspector of Ancient Monuments, and to the Secretary of the Corresponding Societies Committee of the British Association. The proprietor of these valuable remains had hitherto refused to take advantage of the Ancient Monuments Act, though repeatedly requested to do so, neither had he paid due attention to their proper preservation, so that it had been thought desirable to move the foregoing resolution which had been sent to the proper quarter for confirmation by the General Committee of the Association.

Election of Corresponding Societies.—At the termination of the Conference, Mr. Davis raised the question whether a Corresponding Society when once admitted by the Association should not always be retained on the list.

The Secretary explained that the election of Corresponding Societies took place *annually*, and that each of these Societies would be expected to make an annual application for re-election on the printed forms sent out before June. There was no reason why a Society when once elected should not be re-elected every year as long as it kept up its scientific activity. He was of opinion that a failure on the part of a Corresponding Society to send a Delegate to any meeting of the Association should not disqualify that Society for re-election, although it was expected that when a Delegate did attend the meeting of the Association he should be present at the Conferences. Prof. Meldola further stated that some few of the Societies which had been elected last year did not appear in this year's list, the reason being that the Secretaries had not filled in and returned the printed forms sent out at the beginning of the year, nor had any notice been taken of a second application asking whether it was the wish of their Society to be re-elected; so that, as Secretary of the Corresponding Societies Committee, he had concluded that these Societies desired to withdraw, and they had accordingly been removed from the list.

THE COLONIAL AND INDIAN EXHIBITION

RESUMING our notes on some of the principal exhibits (NATURE, vol. xxxiv. p. 548), the Court running parallel with and between those of Mauritius and Seychelles on the one side and Cyprus and Malta on the other was that which contained the collection from the

WEST INDIES.

Vegetable products, as might be expected, formed the bulk of the exhibits in this attractive Court, which had an air of comfort and finish not excelled in any other part of the building. Entering the Court from the northern end, the first bay on the left hand was devoted to

Trinidad, an island celebrated both for the quantity and quality of the cocoa grown upon it, which indeed is the staple article of produce. The value of cocoa exported from Trinidad in 1885 is stated in the Official Hand-book to have amounted to 421,974*l.*, and in some "Notes on Trinidad Industries," by Mr. John McCarthy, F.C.S., the Assistant Commissioner for Trinidad, recently published, it is stated that the quantity of cocoa imported into England in 1885 amounted to 10,560 tons, against 10,120 tons in 1884, and 9986 in 1881. Numerous specimens of cocoa seeds are exhibited, as well as prepared cocoa and chocolate.

Mr. McCarthy describes the cultivation of the cocoanut (*Cocos nucifera*) as a very profitable industry, though the tree does not bear much before it is eight years old. Experiments, he tells us, "are now being tried in Trinidad to make it act as a shade tree to the cocoa (*Theobroma*)" instead of planting the quick-growing "Bois immortelle." The idea of this planting is to realise from the same land a double crop, namely, that from the *Theobroma* and that from the *Cocos*. It is estimated that seventy trees planted upon an acre of land would, when in full bearing, yield 5000 nuts per annum, which would net, on an average, from 3*l.* to 4*l.* per thousand in Trinidad. The annual import of nuts into London is said to be about 12,000,000, besides which, New York imports enormous quantities, and they are also used to a very large extent for the expression of oil in Trinidad itself. Coffee has also a prominent place in the products of Trinidad, and the plant is stated to thrive well, although it has not yet produced even sufficient coffee for home consumption. More attention has, however, been directed of late to coffee culture in the island, so that it is largely increasing. The cultivation of tobacco is also an industry that promises to become of some importance, and the tobacco is described as being second only to the finest Havana. There is a good exhibit of cigars, which are said to have met with general favour, so that a demand has arisen for them.

Bahamas.—In the Official Hand-book, Sir Augustus Adderley gives a very readable sketch of the history of these islands, and briefly refers to the natural products, foremost amongst which are corals and sponges. He describes the "sponging and wrecking vessels" as fine models and fast sailers, built by the islanders of native hard wood known as "horseflesh," and planked with yellow pine obtained from North Carolina. Conch shells are exported in large quantities to the value of about 1200*l.* per annum, and the pale pink pearls which are found in them to the extent of 3000*l.* per annum. The sponge exports were estimated at 60,000*l.* for 1885. Mention is made of the abundance of plants valued as medicines, many of which might be further developed by systematic trial of their effects in this country. Perhaps the two best known medicinal plants are the Canella Bark (*Canella alba*, Murr.) and the Sweet Bark or Cascarilla

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[1] This resolution was adopted by the Committee of Recommendations and confirmed by the General Committee.